

**LIFE HISTORY OF OCHTERUS BANKSI BARBER
(HEMIPTERA: OCHTERIDAE).**

By M. L. BOBB, Charlottesville, Virginia.

The Ochteridae is a small family of semi-aquatic Hemiptera which is represented by only a few species, and these are remarkably uniform in appearance. No complete life history studies have been published on any of the species although Takahashi (1921 and 1923) published observations on *Ochterus formosanus* (Mats.) which is present in Formosa. Hungerford (1919) stated that while Dufour described a nymph of an undetermined species of the genus *Ochterus*, no data are available concerning the egg, or number and length of the instars. Schell (1943) stated that the life history of the family is little known, but that the eggs are deposited upon the surface of grains of sand, plant detritus, and other similar materials. It has been erroneously assumed by some workers (Hungerford 1919) that the winter was spent in the adult stage.

This paper is a report on the life history of *Ochterus banksi* Barber in Virginia for the years 1948 to 1950.

METHODS.

Large aquaria, approximately $12 \times 13 \times 30$ inches, which had a partition about two-fifths the distance from one end were used in rearing individuals of *Ochterus banksi*. The larger end of the aquarium contained seven inches of sand with moss and small clumps of grass growing along the partitioned end. The smaller end was filled with water to a depth of one inch below the level of the sand, and one inch of mud and silt was placed in the bottom in which *Elodea* grew. This water kept the sand extremely moist, and a plate of glass covered the top of the aquarium to permit the keeping of a high humidity within the aquarium.

The different instar nymphs were kept separated by the use of pint fruit jars which had the bottoms removed. The broken end was embedded in the sand, the nymphs put in, food added, and the top closed with a piece of cheesecloth held in place by a rubber band. It was necessary to close the top, since otherwise the nymphs crawled out.

Field collections of the adults were made mostly by picking them up by hand since they hid among the grasses and rocks upon approach of the collector and a net was useless. The nymphs were collected by raking up the debris from an area in which they were

known to be present and confining it in the hopper of a Berlese-type funnel. To the inverted apex of the funnel was attached a jar top into which a pint fruit jar was screwed. The nymphs leaving the debris fell down the funnel and into the jar.

DISTRIBUTION.

Ochterus banksi has been recorded from New York, New Jersey, Virginia, Florida, and Indiana. There are also specimens from South Carolina in the Clemson College insect collection.

Barber (1913) described *Ochterus banksi* from specimens collected by Nathan Banks at Glencarlyn, Arlington County, Virginia, and Schell (1943) records it from Vienna, Fairfax County, Virginia.

The writer has a total of 76 field collected specimens from Virginia. These were collected from five localities in Albermarle County and one locality in Alleghany County.

HABITAT.

This species lives along the shores of ponds and streams. Specimens have been collected from among shore-line plants and rocks, and from sandy beaches along the shore of ponds and streams. The adults move very rapidly and are "experts" at concealing themselves from view. The nymphs are much slower in movement but are difficult to detect since they carry grains of sand on their backs. *Ochterus banksi* has been observed in the same habitats as *Gelastocoris oculatus*, but apparently they are not congenial associates since the latter have been observed feeding on the former several times.

LIFE HISTORY.

Descriptions of the stages and life history data are presented below.

Egg: The egg is white in color and is broadly oval with the micropyle end flattened, and tapering at the other. One side is somewhat flattened and slightly concave. The surface is marked into irregular areas. Length 0.84 mm., width 0.47 mm. (Fig. 1).

First instar: Light brownish in color. Eyes bright red when first hatched, changing to a brownish-red; only slightly elevated. Abdomen short and broadly rounded caudally, segments faintly indicated. Thoracic segments with flat, expanded lateral margins. From 12 to 14 stout spines in a transverse row along the front of head. Rostrum very long and reaching midlength of abdomen; basal third stout, remainder slender. Antennae slender, apparently

three-segmented; terminal segment longer than two basal segments united; reaching lateral margin of prothorax. Legs short and all similar in structure; tarsi with two terminal claws. Length 1.2 mm., greatest width 1.0 mm. (Figs. 2 and 3).

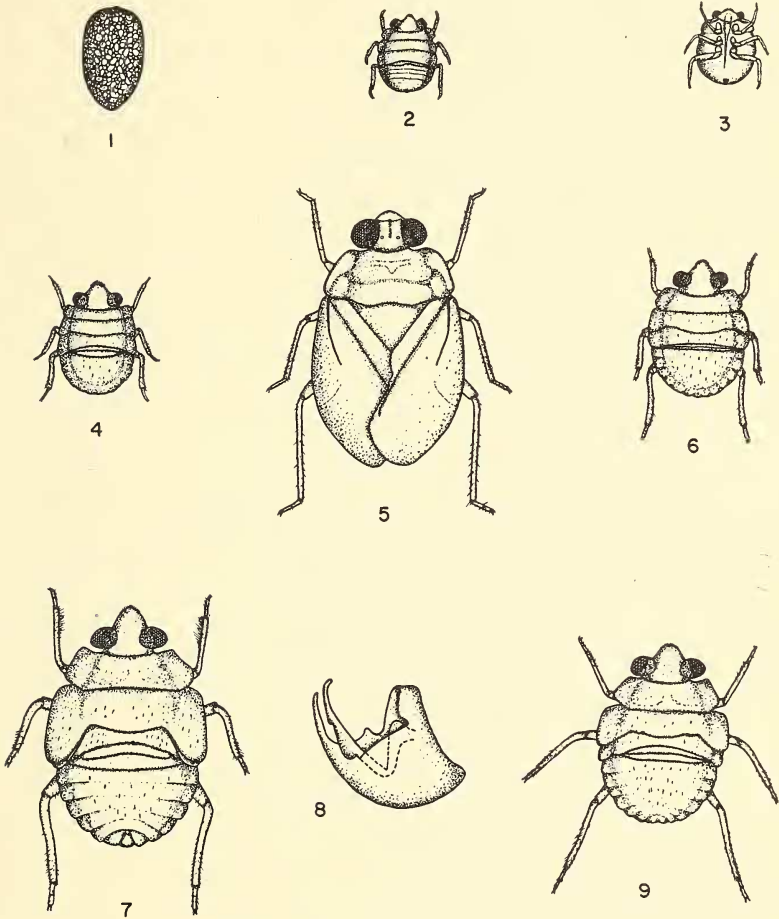
Second instar: Similar to first instar but lateral margins of thorax and abdomen are widely expanded, and eyes are darker and slightly more protruding, slightly convex on inner margin. Antennae four-segmented; segments 1 and 3 slender, subequal in length; segment 2 very stout, longer than 1; segment 4 long, subequal to 2 and 3 united, tapering to apex. Length 1.8 mm., greatest width 1.4 mm. (Fig. 4).

Third instar: Eyes more prominent and protruding, concave on inner margin. Lateral margins of body widely expanded. Rostrum long, and apical two-thirds very slender. Antennae and legs similar to second instar but longer and stouter. Fourteen stout spines in a transverse row on front of head. Wing-pads showing slight development. Length 2.2 mm., greatest width 1.7 mm. (Fig. 6).

Fourth instar: Very similar to fifth instar. Abdomen marked into segments along lateral margins but dorsum appears unsegmented. Antennae with segments 1 and 2 stout, subequal; segment 3 slender, slightly longer than 2; segment 4 slender, as long as 1 and 2 united, tapering to apex. Wing-pads showing more rapid development. Length 3.0 mm., greatest width 2.1 mm. (Fig. 9).

Fifth instar: Nymphs yellowish-white when first molted but soon changing to a light brownish color. Integument shiny when coating of mud and sand is removed. Eyes dark brownish-black, strongly protruding and elevated. Lateral margins of thorax and abdomen broadly expanded. Fourteen stout spines in transverse row along front of head. Rostrum long and slender, reaching beyond hind coxae. Antennae with segments 1 and 2 stout, subequal; segments 3 and 4 slender, subequal, each slightly shorter than 1 and 2 united. Middle tibiae slightly curved and hind tibiae strongly so; tarsi with two large claws. Mesothoracic wing-pads extending caudally to first abdominal segment, nearly obscuring the metathoracic wing pads. Length 4.0 mm., greatest width 2.7 mm. (Fig. 7).

Adult: Broad ovate, brownish-black. Head behind vertex opaque, from there cephalically, shining and obliquely, finely rugulose and tricarinate. Pronotum with cephalic margin subtruncate, the cephalolateral angles rounded and not projecting cephalid or lateral beyond the exterior margin of eyes; lateral margins broadly



EXPLANATION OF PLATE V

All figures are of *Ochterus banksi* Barber. FIG. 1. Egg. FIG. 2. First instar nymph, dorsal view. FIG. 3. First instar nymph, ventral view. FIG. 4. Second instar nymph. FIG. 5. Adult. FIG. 6. Third instar nymph. FIG. 7. Fifth instar nymph. FIG. 8. Genital capsule of male. FIG. 9. Fourth instar nymph.

expanded, pale. Costal margins of corium either broadly pale or in part suffused with fuscous, without the usual series of pale marginal spots which occur in *americanus*. Right paramere of male genital capsule with semi-heart-shaped lobe on outer margin (Fig. 8). Length 4.1 mm. to 4.5 mm. (Fig. 5).

A general picture of the life history of *Ochterus banksi* is shown by seasonal collecting data. Adult males and females have been collected in approximately equal numbers during late May, June (majority), and early July; second instar nymphs during July, August, and early September; third instar nymphs during August and September; fourth instar nymphs during January, February, March, April, August, September, October, November, and December; and fifth instar nymphs during April, May, and June.

From these collecting data it can be seen that the winter is passed in the fourth nymphal stage, the nymphs hibernating under leaves, among mosses, and in other debris along the shores of ponds and streams. The nymphs will not progress beyond the fourth instar until subjected to cold weather, even though they reach the fourth nymphal stage in late July or early August. A number of fourth instar nymphs have been subjected to refrigeration for varying intervals, and it was found that they require a minimum period of two weeks of temperatures of 45° F. or less to cause them to continue development.

After passing the winter as fourth instar nymphs they molt in early spring into the fifth instar, and become adults in May and June. Several weeks elapse after the final molt before eggs are found in the oviducts. Dissections of numerous females have shown that egg development is a slow and gradual process, and that no more than two or three apparently mature eggs are present in the oviducts at one time. About 25 to 30 was the maximum number of eggs produced by a female in captivity, and this number was developed over a period of approximately two months. The eggs are deposited singularly on plant debris and on grains of sand. In the aquaria the majority of the eggs were found attached to semi-exposed roots of grass clumps and to dead grass and leaves.

In nature the first instar nymphs remain in clumps of mosses and among the grasses growing along the shore and are extremely difficult to find. The older nymphs wander from under the debris and move slowly over the sand or mud, and have been observed in shallow water. All stages of nymphs are covered with a thin coating of silt which is almost impossible to remove from their dorsa, and all carry from two to six grains of sand on their backs. They

scoop up the sand by means of the transverse row of stout spines on the front of the head and push it back onto the thorax and abdomen with the front pair of legs. This is a characteristic of all nymphal stages and if the sand grains are removed, as has often been done with a camel's-hair brush, they begin putting more sand on their backs within a very short time.

A day or two before each molt the nymphs construct small individual cells in the moist sand. After they are in the cells, sand is pushed up along the sides until only a very small hole is left in the top. The nymph remains motionless in the bottom of the cell for a few hours or a day and then the old integument splits along the mid-dorsal line of the thorax and the newly molted nymph crawls out. After a short time it leaves the cell and roams around in search of food. The exuvia is left in the cell.

The adults and nymphs feed on various small insects and crustacea. One fourth instar nymph was observed feeding on a crus-

TABLE 1

Summary of life history data on *Ochterus banksi* Barber at Charlottesville, Virginia in 1948-1949.

Individual Number	Length of egg stage and nymphal instars in days						
	Egg	First	Second	Third	Fourth	Fifth	Total
1	17	13	8	23	208	23	292
2	18	11	10	36	196	27	298
3	18	12	9	37	201	24	301
4	18	13	10	40	201	22	304
5	19	12	10	39	205	21	306
6	18	13	11	36	204	23	305
7	20	11	12	34	208	18	303
8	19	16	11	34	207	20	307
9	18	12	10	33	204	22	299
10	20	12	13	34	202	21	302
11	19	13	15	31	198	26	302
12	21	12	11	33	199	26	302
13	19	15	14	34	194	25	301
14	20	12	21	35	183	28	299
15	18	12	17	36	181	24	288
Average	18.8	12.6	12.2	34.3	199.4	23.3	300.6

tacean (*Gammarus* sp.) fully three times the size of the nymph. In the life history studies they were fed on springtails, fly larvae, and aphids. The adults were very shy but always demonstrated curiosity. If a large insect was dropped into the aquarium the adults would soon investigate, but the nymphs seemed to find the food more or less by chance. *Ochterus banksi* is not cannibalistic, even when food is extremely scarce. The adults have fully developed wings but they have never been observed to fly in the laboratory or

TABLE 2

Summary of life history data on *Ochterus banksi* Barber at Charlottesville, Virginia in 1949-1950.

Individual Number	Length of egg stage and nymphal instars in days						
	Egg	First	Second	Third	Fourth	Fifth	Total
1	20	14	12	29	215	22	312
2	18	12	12	22	223	26	313
3	18	13	9	26	226	24	316
4	18	13	11	31	212	22	307
5	21	15	12	34	216	23	321
6	21	14	14	32	219	24	324
7	19	17	10	41	214	18	319
8	22	11	11	29	213	28	314
9	18	13	13	40	202	25	311
10	18	13	14	39	220	24	328
11	19	13	12	39	197	25	305
12	20	12	13	38	209	26	318
13	18	14	12	38	219	25	326
14	20	11	14	36	207	23	311
15	19	13	12	37	222	21	324
16	18	12	17	32	204	23	306
17	18	12	13	35	218	23	319
18	20	14	14	37	217	20	322
19	17	12	14	27	229	27	326
20	18	11	19	32	216	25	321
21	15	12	14	36	208	22	307
22	16	12	13	35	214	25	315
23	17	13	15	30	216	21	312
Average	18.6	12.8	13.0	33.7	214.6	23.6	316.4

in nature. They sometimes jump when startled, but usually run along the ground.

The life history data presented in tables 1 and 2 were obtained from studies of the insect in a large aquarium in a building which was kept at a constant temperature of 75° F. In order that the nymphs might continue development past the fourth instar they were transferred during December to other aquaria in an open insectary. The nymphs were left in these outdoor aquaria until they began to molt into the fifth instar. As soon as molting began all nymphs were transferred back to the aquarium in the heated building where they completed their development. Due to this it will be noted in the tables that the average duration of the egg and nymphal stages for the two years very closely approximate each other, except that the fourth instar was longer in 1949-1950 than in 1948-1949. This longer period in the fourth instar is more normal. The mid-February temperatures in 1949 were unusually high (67° F. on the 13th, 69° F. on the 14th, and 72° F. on the 15th), and caused the nymphs to begin molting. Since the nymphs were transferred to the aquarium in the heated building in late February, the fourth nymphal period was lessened. The date the eggs were deposited in 1948 varied from June 2 to July 3 and in 1949 from May 18 to June 26, and hatched from June 19 to July 21 in 1948 and from June 7 to July 13 in 1949. The nymphs molted to the second instar from July 2 to August 2 in 1948 and from June 21 to July 26 in 1949; to the third instar from July 10 to August 23 in 1948 and from July 1 to August 10 in 1949; to the fourth instar from August 2 to September 27 in 1948 and from July 25 to September 9 in 1949; to the fifth instar from February 26 to March 25 in 1949 and from March 18 to April 2 in 1950; and to the adult from March 20 to April 21 in 1949 and from April 9 to May 8 in 1950.

Data are presented only for a two-year period although a number of individuals were reared in 1947. During 1947 the data were confused due to the failure to distinguish between the exuvia in the "molting cells" and the living nymphs, and not until more nymphs were present in the aquarium than had been placed there was it realized that this distinction had not been made. Even though the 1947 data was of little value, much was learned of importance in later studies. One of the most beneficial findings was that the nymphs need moist sand and a high humidity in order to molt successfully. A high percentage of the individuals were unable to transform into the next instar in a dry atmosphere although

they seemed to do well between molts. The average number of days in the fifth instar for seven individuals reared in early 1948 and not included in tables 1 and 2 was 24.7.

SUMMARY.

Life history studies on *Ochterus banski* Barber are presented for the years 1948 to 1950, and descriptions of all life stages are given and figured.

The eggs are deposited singularly on semi-exposed roots of grass clumps and on plant detritus, and hatch in from 15 to 22 days. The first nymphal instar lasts from 11 to 17 days, the second instar from 8 to 21 days, the third instar from 22 to 41 days, the fourth instar from 181 to 229 days, and the fifth instar from 18 to 28 days.

The winter is passed in the fourth nymphal instar, the individuals hibernating under leaves, among mosses, and in other debris along the shores of ponds and streams. The nymphs will not progress beyond the fourth instar until subjected to a minimum period of two weeks of temperatures of 45° F. or less.

All nymphal stages construct small individual cells in the moist sand in which they molt.

All nymphal stages carry from two to six grains of sand on their dorsa. These are scooped up by means of a transverse row of stout spines on the front of the head and pushed back onto the thorax and abdomen with the front pair of legs.

LITERATURE CITED

- Barber, H. G.** 1913. Descriptions of two new species of *Ochterus* Latr. (Hemiptera) with an arrangement of the North American species. *Can. Ent.* 45: 213-215.
- Hungerford, H. B.** 1919. The biology and ecology of aquatic and semi-aquatic Hemiptera. *Univ. Kan. Sci. Bull.* 11.
- Schnell, D. V.** 1943. The Ochteridae (Hemiptera) of the western hemisphere. *Journ. Kan. Ent. Soc.* 16: 29-46.
- Takahashi, R.** 1921. (Observations on the Ochteridae). (In Japanese). *Trans. Nat. Hist. Soc. Formosa* 11: 119-125.
- Takahashi, R.** 1923. Observations on the Ochteridae. *Bull. Brook. Ent. Soc.* 18: 67-68.